

1. Specify: ☒ agricultural project or ☐ urban project ☒ individual application or ☐ joint application
2. Proposal title—concise but descriptive: Increasing Water Use Efficiency Through Total Utilization of Drainage Water & Minimization of Surface Evaporation (Advanced Integrated On-Farm Drainage Management Program)
3. Principal applicant—organization or affiliation: Westside Resource Conservation District
4. Contact—name, title: Morris A. "Red" Martin, Manager
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6. Telephone: (559) 227-2489
7. Fax: (559) 227-0215
8. E-mail: redmartin@psnw.com
9. Funds requested—dollar amount: \$ 111,280
10. Applicant cost share funds pledged—dollar amount: \$ 36,750
11. Duration—(month/year to month/year): July, 2001 to June, 2004
12. State Assembly and Senate districts and Congressional district(s) where the project is to be conducted: 30th State Assembly District; 16th State Senate District; 20th Congressional District
13. Location and geographic boundaries of the project: Western Fresno and Kings counties; CALFED Sub-Regions 14 & 10 (Drainage Problem Area)
14. Name and signature of official representing applicant. By signing below, the applicant declares the following:
 - the truthfulness of all representations in the proposal;
 - the individual signing the form is authorized to submit the application on behalf of the applicant;
 - the applicant will comply with contract terms and conditions identified in Section 11 of this PSP.

Morris A. Martin February 14, 2001
(printed name of applicant) (date)

Morris A. Martin
(signature of applicant)

**Water Use Efficiency Program Proposal
CALFED Bay-Delta Program
February 14, 2001**

B. Scope of Work

Relevance and Importance

B-1.) Abstract (Executive Summary):

The water use efficiency proposed project of the Integrated On-Farm Drainage Management (IFDM) Program at the Red Rock Ranch in western Fresno County will address the CALFED Quantifiable Objective 164 for Sub-region 14 by reducing nonproductive evapotranspiration through the full recovery of drainage water through a solar distillation process and use of subsurface irrigation membrane technology. The total cost of the two-part proposed project is \$148,030, with in-kind contributions of \$36,750 and the CALFED request of \$111,280. The ultimate goal of the proposed project is to achieve up to 100 percent utilization of all surface and drainage water on the farm.

The first component of the proposed project is a solar distillation process to achieve the full recovery of the remaining 10 percent of drainage water produced from the IFDM Program. The solar distillation process will create salts as by-products (calcium carbonate, magnesium sulfate, sodium sulfate and sodium chloride), which may have commercial or industrial value, and will produce high-quality water. The process is designed to achieve a full recovery of drainage water without adverse environmental impacts and to utilize the production of high-quality distilled water for irrigation or municipal and industrial uses where applicable.

The second component uses enhanced membrane technology for the subsurface irrigation of crops. Both components of the proposed project will enhance the design of the IFDM Program, which is successful in managing drainage water, salt and selenium as resources rather than wastes. The state-of-the-art irrigation technology and complete drainage water reuse will improve water availability for crop production and will minimize salt and selenium risks to water quality and the environment.

The IFDM Program is a viable alternative for those landowners who may not be able to participate in a voluntary land retirement program for drainage-impacted lands. Whatever solution is ultimately selected to manage drainage and salinity on a regional basis, the IFDM Program is a necessary first-step to improve on-farm irrigation efficiencies and water conservation and to reduce the volume of drainage effluent that will eventually need treatment and/or disposal.

Principle objectives of this proposed project for the IFDM Program are: 1.) To achieve up to 100 percent utilization of all surface and drainage water on the farm; 2.) To manage salt and selenium from drainage water directly on the farm; and 3.) To enhance environmental benefits of the IFDM Program.

The practical application of research conducted by several local, state and federal agencies on the Red Rock Ranch IFDM Program is developing an overall salinity management / irrigation efficiency program that will have widespread application throughout the drainage-impacted region on the Valley's west side. The salt-reduction need is embodied in CALFED Quantifiable Objective 106 for drainage problems areas in Sub-region 10.

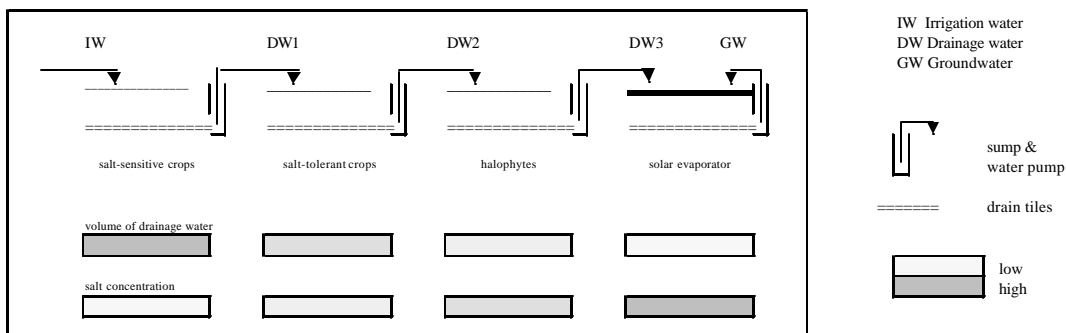
The methods used in this proposal will consider data from the Red Rock Ranch IFDM Program, such as salt and selenium inflows, water volumes and quality, level of water tables, soil characteristics and the characteristics of cropping systems. The IFDM Program uses about 90 percent of the drainage water produced on the farm to irrigate crops. Through this proposal's enhanced design, it is hoped to achieve up to 100 percent utilization of drainage water to help meet water supply uncertainty for crop production and to further reduce contribution to the saline shallow groundwater table. The proposed project will be developed from the experience acquired since 1991.

The IFDM Program manages irrigation water on high-value crops and reuses drainage water to irrigate salt-tolerant crops, trees and halophyte plants. Salt and selenium are removed from the farming system and can be marketed. This system views drainage water, salt and selenium as resources, rather than considering them as wastes and ecological problems.

The grower sequentially reuses drainage water to produce crops of differentiated salinity tolerance. A solar evaporator receives the final volume of drainage water. This water evaporates and salt crystallizes. The plants uptake selenium, which also volatilizes. The remaining selenium becomes a component of harvested salt. There is no disposal of salts and selenium into rivers or evaporation ponds. Drainage water, salts and selenium do not leave the farm.

The basic outline of the sequential reuse of drainage water is shown in Schematic Drawing 1 on page 3. The IFDM Program at Red Rock Ranch includes approximately 470 acres of salt-sensitive crops. The drainage water from salt-sensitive crops is used to irrigate about 130 acres of salt-tolerant crops/trees and 13 acres of salt-tolerant grasses. Five acres of trees are used to intercept the subsurface flow of water and salts. A shared drainage system exists for the five acres of halophytes and the two-acre solar evaporator.

Under the current process, the disposal of concentrated drainage water into the solar evaporator is correlated with daily evaporation rates. No more than 8-to10 mm is discharged daily in the solar evaporator, reducing any environmental hazard to wildlife. Solar energy is used to evaporate the drainage water. A goal of this proposed project is the potential elimination of the solar evaporator process, replacing it with the closed-system solar distillation to eliminate the environmental risks from exposure of drainage water.



Schematic Drawing 1

B-2.) Statement of critical local, regional, Bay-Delta, State or federal water issues, which includes an explanation of the need for the project, who wants it and why.

The proposed project will fill a critical local and regional need to manage salinity and drainage problems on the west side of the San Joaquin Valley by achieving significant water savings and a reduction in the contribution to the saline shallow groundwater table.

The water savings from the reduction of nonproductive evapotranspiration (ET) and subsequent increase in supply for irrigation addresses the Quantifiable Objective 164 for this sub-region. In addition, the proposed project will address the CALFED Quantifiable Objective 106 for Sub-region 10 to decrease in-flows to salt sinks. Additionally, the Targeted Benefit Categories by Sub-Region as identified by Table 1.1 and 1.2 (Draft Details of Quantifiable Objectives) apply to this proposed project, specifically focusing on the reduction of salinity and native constituents such as selenium, and sediment management through controlled irrigation-induced erosion.

Three of the four CALFED Bay-Delta Program objectives – ecosystem quality, water supply and water quality – can be met by implementation of the IFDM Program, including the components identified in this proposed project. In addition, the implementation of IFDM Programs in areas that presently drain into the San Joaquin River can help reduce the volume of drainage effluent entering the San Joaquin River, subsequently improving water quality.

The west side of the San Joaquin Valley is plagued with a build-up of salts, selenium, boron and other naturally occurring elements. Dense soil and shallow clay layers cause the build-up of these salts and other elements by preventing unused irrigation water from percolating into the deep aquifer.

Without natural drainage, the agricultural productivity of the region has been diminished and water quality and ecosystems are at risk. As the saline drainage water encroaches into the crop root zone, crop yields are reduced, crop choices are limited, and over time, crop production is eliminated altogether. Likewise, water quality and the Sacramento-San Joaquin Bay-Delta estuary ecosystem are impacted by the build-up of salts, selenium and other elements.

Since 1985, several water and resource management agencies have been developing an on-farm drainage management program. The IFDM Program evolved

from the agroforestry concept and was developed by the Westside Resource Conservation District, California Department of Water Resources, California Department of Food and Agriculture, USDA-Natural Resource Conservation Service, California State University, Fresno and University of California, Davis. The Regional Water Quality Control Board and U.S. Fish and Wildlife Service also have participated.

Red Rock Ranch owner John Diener and other growers in the WRCD have played a leading role in the development of the IFDM Program. A professional staff of several government agencies, universities, and consultants provide the required technical assistance. Mr. Diener and the U.S. Bureau of Reclamation fund the project.

Interest in the IFDM Program has been widespread. To date, six IFDM projects are being considered in drainage-impacted areas on the west side and in Kern County. Likewise, farmers and water districts in the Grasslands Drainage Basin have expressed interest in developing IFDM Programs to help reduce selenium load levels and drainage effluent in their discharge outlets. The IFDM Program offers benefits to water managers, growers and political leaders by providing a practical example of integrated farming and engineering methods to protect the quality of rivers, groundwater resources, soils and the environment. The continued research and practical on-farm applications conducted at Red Rock Ranch as identified in this proposal will improve the applicability of this program to other drainage-impacted areas.

The IFDM Program and the specific components of this proposal are consistent with local and regional water and drainage management plans. The Federal-State Interagency San Joaquin Valley Drainage Program's final report, *A Management Plan For Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley, September 1990*, recommends several measures for managing subsurface agricultural drainage, which are employed in the IFDM Program. The major components include source control (water conservation practices), sequential reuse of drainage water and the treatment and/or disposal of drainage water. The proposal is an essential part of the implementation strategy as developed by the San Joaquin Valley Drainage Program.

B-3.) Nature, scope and objectives of the Project:

The first component of the proposed project, the solar distillation, reclaims and recovers the last 10 percent of the drainage water produced from the IFDM Program. High-quality water is produced and salts and other naturally occurring elements are removed from the drainage water.

The second component of the proposed project includes the use of a subsurface irrigation membrane system in the field, which separates constituents such as salts, while at the same time allowing the clean water to pass through the membrane. The water condenses in the soil for the plant to use as needed, keeping the salts and other elements in the membrane and out of the crop root zone.

The water use efficiency objectives of this proposal are:

- (1) To demonstrate an integrated system for the management of irrigation and drainage waters, salts and selenium, enhanced by a solar distillation process to achieve up to 100 percent utilization of all water used on the farm and use of subsurface irrigation technology. All water – surface and drainage—is put to full beneficial use for the production of food and fiber crops, with no drainage water ever leaving the farm.
- (2) To design, implement and operate an advanced irrigation/drainage water management system as a practical model for other growers and water/drainage districts to follow.
- (3) To monitor and analyze data on source control, water sequential reuse, salt and selenium removal, wildlife habitat and other system components.
- (4) To evaluate the interaction of food production and wildlife ecology within well-designed and managed operations on irrigated farmland.
- (5) Create a demonstration and educational project for the benefit of growers, water managers, administrators, students, political leaders and the public in California.

This proposed project hopes to build on the successes in efficient water use already quantified, meeting the CALFED Quantifiable Objectives 164 for Sub-Region 14: “Decrease nonproductive ET to increase water supply for beneficial uses.” The IFDM system increases the overall efficiency of water use. While conventional farming on 640 acres would require about 1,550 acre-feet of surface irrigation water, by reusing drainage water this IFDM system requires only about 1,215 acre-feet of irrigation water, a water saving of 22 percent. The sequential reuse of about 90 percent of drainage water to irrigate salt-tolerant crops contributes to this water conservation. The addition of subsurface irrigation technology and the recovery and reuse of the remaining 10 percent as distilled drainage water is expected to improve the overall efficiency.

Technical/Scientific Merit, Feasibility, Monitoring and Assessment

B-4.) Methods, procedures and facilities

The proposed subsurface irrigation membrane technology employs the proprietary technology to meet Objective 164 for Sub-Region 14 by reducing nonproductive evapotranspiration and subsequent increase in supply for irrigation. In addition to reducing evapotranspiration losses by using subsurface application, the polymeric membrane will act to filter the contaminants while allowing clean water to pass through the membrane for plants to use as needed. This technology will allow growers to grow high-value crops in low-quality water conditions. The filtered water will facilitate higher crop yields. This technology’s estimated water savings will result from the elimination of water run-off and water evaporation from the surface application of irrigation water.

A solar distillation process will be used to achieve up to 100 percent utilization of all surface and drainage water on-farm. The IFDM Program now uses about 90 percent

of the drainage water to produce salt-tolerant crops, grasses and halophytes. An opportunity exists to recover almost all the remaining 10 percent of drainage water discharged into the solar evaporator. Instead of discharging into an open system -- the solar evaporator -- a closed system solar distillation system will help to reclaim the last 10 percent of drainage water. The distilled water will result in high-quality water for agricultural, municipal and industrial uses.

B-5.) Schedule.

A schedule outlining tasks, deliverable items, due dates, projected costs for each task and a quarterly expenditure projection for the proposal during a 3-year period is shown in Table B6 on page 7.

B-6.) Monitoring and assessment.

The progress towards the Quantifiable Objective Number 106 (decreased flows to salt sinks) will be measured by monitoring the inflow of saline water, outflow of distilled water, saline water in the pre-concentration and solar still units for evaporation, electrical conductivity, selenium, pH and temperature. The environmental conditions will be measured, both indoor and outdoor of the units, for: humidity, temperature and barometric pressure. Progress toward the Quantifiable Objective Number 106 will be measured daily and from prepared monthly comparisons of baseline and post-project as the result of implementing the solar still evaporation/distillation processes. The volume of condensate will be collected in the pre-concentration unit and solar still. Monitoring data will be collected, evaluated and made accessible for technology transfer. A summary of baseline data and post-project projections of evaporation rates is presented in Figure 1 on page 12. The comparison of baseline data to post-project results will be submitted with each progress report.

Monitoring of the irrigation membrane technology will include comparison of the data from the “membrane field” and from a control field using conventional furrow- or flood-type irrigation practices. An assessment will be made to determine the extent to which the irrigation membrane technology meets to Quantifiable Objective Number 164 (decrease nonproductive ET). The volume and quality of irrigation water inflows and drainage water outflows will be monitored, as well as soil conditions before and after the field test. Crop yields and wildlife conditions will be monitored in both the control and “membrane” field. Water savings and cost benefits will be evaluated.

C. Outreach, Community Involvement, and Information Transfer

C-1.) Describe outreach efforts to contact and involve participation from people in disadvantaged communities.

The IFDM Program can provide benefits to people in rural communities by helping sustain the local farm economy by providing a management alternative to the retirement of drainage-impacted farmland. Farms that go out of production resulting from drainage-induced problems and/or chronic water shortages can create serious

Table B6: Schedule for 100% Recovery of Drainage Water & Subsurface Membrane Technology

economic impacts to local rural communities.

West side towns, like Mendota and Firebaugh, already are plagued with double-digit unemployment due to the seasonal nature of agriculture. Unemployment has increased on the west side resulting from water shortages, cropping changes from salinity problems and the fallowing of drainage-impacted lands. Likewise, the decline in productivity from salinity and water shortages has created hardships for local school districts, which have seen a decline in enrollment due to the reduction in farmworker jobs.

Furthermore, the technologies employed in this proposed project can help create new diversified career opportunities through the construction of solar still facilities and in the manufacturing and marketing of the subsurface irrigation technology. The possible commercial and industrial uses from the salt by-products can create a new value-added industry for the region, which is seeking to diversify its agricultural employment base.

C-2.) Training, employment, and capacity building potential.

The five-year IFDM Program at Red Rock Ranch has demonstrated that the use of IFDM on a larger scale is possible and practical. Several farms and water districts are in the initial stages of implementing IFDM Programs on the west side. In fact, four courses on developing IFDM Program were held in 1999 with over 150 farmers, technicians and professionals attending.

The merits of the IFDM Program have been recognized by the U.S. Environmental Protection Agency and State Water Resources Control Board. The WRCD received a Clean Water Act Section 319(h) Grant for \$350,000 from the State Water Resources Control Board to educate farmers and provide a certification program to train professionals on implementing IFDM systems. The Grant will target the needs of the farm owners, water/drainage district managers, engineers and technical professionals. For his pioneering work in the IFDM systems, John Diener received Governor's Environmental and Economic Leadership Award in 1999, and the Irrigator of the Year Award from CSU, Fresno in 1998 and *The California Vegetable Journal*.

The certification program for IFDM will be developed to train individuals in the environmental management and specific engineering, hydrologic and agronomic techniques necessary to develop a successful IFDM Program, utilizing new technologies developed by this proposed project. Technical and educational experts within several government agencies, universities and consulting organizations will assist in the development of this Certification Program. The government agencies will include the USDA--Natural Resource Conservation Service, California Department of Water Resources, California Department of Food and Agriculture, Regional Water Quality Control Board and the U.S. Fish and Wildlife Service. Certified professionals will be trained in CEQA and permitting requirements for IFDM systems including the information needs to apply for waste discharge requirements.

C-3.) Describe the plan for disseminating information on the results of the project and promoting their application.

The Section 319(h) funds will be used to develop an education and outreach program, including tours of the IDFM Program at Red Rock Ranch, development of a model design of halophyte areas and solar evaporators, identification of salt-tolerant plant materials, and evaluation of water conservation and the balance of salt and selenium in these projects. Additional outreach efforts include meetings with small groups of growers in salinity and selenium-impacted areas, use of a Geographic Information System (GIS) to include salinity problem areas, and track IFDM programs in western San Joaquin Valley, the development of a guide/handbook for the implementation of IFDM programs for the landowners and farm managers, and distribution of the guide/hand book. The Community Alliance with Family Farmers (CAFF) along with other established educational and industry organizations will be used to distribute information to the landowners in the affected areas. Researchers from the U.C. Cooperative Extension Service, University of California, Davis and California State University, Fresno will also participate in the outreach program.

The education and outreach program is essential for achieving the environmental and economic benefits of IFDM Program. The desired outcome of this proposed project is to have trained professionals to assist farmers and landowners in the development of IFDM Programs throughout all salinity/drainage-impacted areas throughout California and the western United States.

C-4.) Provide a copy of the letter sent to the local land use entity, water district or other potentially impacted or cooperating agencies notifying them of the proposal.

A copy of the letter is attached, Appendix.

D. Qualifications of the Applicants, Cooperators, and Establishment of Partnerships

D-1.) Include a resume of the project manager.

A resume of Project Manager Morris A. Martin is attached, Appendix.

D-2.) Identify and describe the role of any external cooperators that will be used for this project.

Several external cooperators will be involved in the proposed project. The California Department of Water Resources will provide technical expertise to the Westside Resource Conservation District in development, operations and evaluation of the project. The USDA Natural Resources Conservation Service will provide technical assistance to the District and will help disseminate project results to growers. The U.S. Fish and Wildlife Service will assist in providing environmental and wildlife safety evaluations. The California Department of Food and Agriculture will help in disseminating project results to growers. The irrigation membrane technology will be done in cooperation with the CSU, Fresno--Center for Irrigation

Technology. The project will be done with close consultation and coordination with the Regional Water Quality Control Board.

D-3.) Provide information about partnerships developed to implement the project.

A successful IFDM Program must have solid partnerships at its core. As discussed previously, several local, state and federal agencies have been involved in the development of the IFDM Program at Red Rock Ranch. These partnerships will continue to play an active role in the implementation of this proposal.

E. Costs and Benefits

E-1. Budget summary and breakdown.

The total project cost is estimated at \$148,030, in-kind contribution of \$36,750 and CALFED request of \$111,280. A detailed budget summary and breakdown is shown in Table E1-3, Appendix.

E-2.) Budget Justification.

A subtotal for "other direct costs" is projected to be \$103,280. A portion of "other direct costs", \$40,000 will allow for five additional solar still designs. Additional solar still designs will promote improved efficiency, increased benefits and decreased costs. Subsurface irrigation system costs are \$30,000. Equipment costs include monitoring devices to measure efficiency of the solar still and tractor work for land preparation. Pipe and sprinkler costs are included as accessories to the solar still system. This project will provide water savings from reduction nonproductive ET and subsequent increase in supply for irrigation benefits. Other CALFED Bay-Delta benefits include improving both ecosystem quality and water quality. The amount of water savings and increase in supply for irrigation is described in Section B4.

E-3.) Benefit Summary and Breakdown.

E-3a. Quantify project outcomes and benefits.

This project will provide benefits in water conservation, up to 100 percent utilization of irrigation and drainage water, and salt harvest. The project will increase water savings and increase the water supply for irrigation. Salt harvest will provide environmental benefits. On-farm technology is presently being developed for the harvest of salt of required quality standards. Efforts are underway to develop new farm-salt products. Water conservation and salt harvest will provide benefits to the growers, water districts and the State.

E-3b. For project outcomes and benefits that are not quantifiable, provide a qualitative description of such project outcomes and benefits.

This project is expected to improve salt and selenium management on farms, increase the water supply for irrigation and municipal/industrial purposes, allow for non-

state/regional management of drainage water (including salt and selenium), and provide technology transfer to other farms. The project will improve the management of selenium, and thus, reduce environmental risks. The growers, State, CALFED and communities will benefit from these contributions.

E-4. Assessment of Costs and Benefits.

E-4a. List and explain all major analysis assumptions.

The project proposal will allow the presented technology to be transferred to at least 300,000 acres of drainage-impacted land. The sphere of influence includes the Grasslands Basin and Westlands Water District. Quantified costs were estimated for engineering and construction materials that will provide quantified benefits towards water conservation and salt harvest. An additional 10 percent of irrigation water will be conserved for 300,000 acres at 2.5 AF/AC at 10%. Salt values range from \$0/ton to \$80/ton; a conservative value of \$20/ton was used for estimating benefits. Salt flow was estimated at 1 ton/acre for 300,000 acres. A sustainable system is 100 percent efficient.

E-4b. All benefits and costs are expressed in year 2000 dollars.

E-4c. All costs and benefits were converted to their present value equivalents prior to aggregating them.

E-4d. Compile a table showing the present value of the quantified costs and benefits for the applicant, each project beneficiary, CALFED, and any other parties affected by the project.

Table: E-4d, Appendix represents the present value of the quantified costs and benefits for the proposed project, each project beneficiary, CALFED and any other parties affected by the project.

Appendix
Westside Resource Conservation District
CALFED Water Use Efficiency Grant Proposal

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Project Manager Morris A. “Red” Martin

Morris A. “Red” Martin graduated from Fresno State College (now California State University, Fresno) in 1951, with a Bachelor of Arts degree in agriculture, majoring in animal science with a minor in natural resources. He has completed post-graduate work in environmental planning.

In 1955, he began his career with the U.S. Department of Agriculture Soil Conservation Service as a soil conservationist. In 1965, he became the district conservationist responsible for Fresno County. In 1980, he became area conservationist responsible for the San Joaquin Valley and Eastern California.

The Soil and Water Conservation Society with the International Erosion Control Association have granted him the use of the professional designation of Certified Professional in Erosion and Sediment Control (CPESC No. 307). He retired from the now-Natural Resources Conservation Service in 1987 after a career of 35 years of federal service.

In 1990, he became manager/secretary/treasurer of the 1.1-million-acre Westside Resource Conservation District, covering western Fresno and Kings counties. In this new career, Martin administers a number of agreements, contracts and grants from state and federal agencies and private foundations for the planning and application practices for soil and water conservation.

Table E-1-3: Budget Summary

Page 3

100-Percent Recovery of Drainage Water and Subsurface Membrane Technology
(Technology to be transferred to 300,000 acres of land affected by drainage problems) (1)

Item	Amount	Units	Quantity	Total Cost	Units	Life (years)	Present Value	Local Share	CALFED Request (\$)
a. Salaries and Wages									
1) Labor	50	\$/day	365	18,250	\$/day	15	18,250	18,250	0
b. Fringe Benefits									
1) Educational Field Days	5,000	\$	1	5,000	\$	15	5,000	5,000	0
c. Supplies	3,000	\$	1	3,000	\$	15	3,000	3,000	0
d. Equipment									
1) Level Controls	2,000	\$	1	2,000	\$	15	2,000	0	2,000
2) pH Conductivity	2,000	\$	1	2,000	\$	15	2,000	0	2,000
3) Temperature	2,000	\$	1	2,000	\$	15	2,000	0	2,000
4) Humidity	2,000	\$	1	2,000	\$	15	2,000	0	2,000
5) Tractor	35	\$/hr	300	10,500	\$/hr	15	10,500	10,500	0
Subtotal:				18,500					
e. Services and Consultants [None]									
f. Travel [None]									
g. Other Direct Costs									
1) Planning	7,280	\$	1	7,280	\$	5	7,280	0	7,280
2) Pre-Fabricated Solar Still	8,000	\$	1	8,000	\$	15	8,000	0	8,000
3) Pre-Concentrator	8,000	\$	1	8,000	\$	15	8,000	0	8,000
4) Condenser	8,000	\$	1	8,000	\$	15	8,000	0	8,000
4) Distilled Water Return System	2,000	\$	1	2,000	\$	15	2,000	0	2,000
5) Solar Still Designs (5 designs)	8,000	\$	5	40,000	\$	15	40,000	0	40,000
6) Subsurface Irrigation System	30,000	\$	1	30,000	\$	15	30,000	0	30,000
Subtotal:				103,280					
h. Total Estimated Costs							148,030	36,750	111,280

(1) Grassland and Westland Water Districts.

Table E-4d: Summary of Quantified and Non-Quantified Costs and Benefits

Page 4

100-Percent Recovery of Drainage Water and Salt Harvest

(Technology to be transferred to 300,000 acres of land affected by drainage problems) (1)

Item	Amount	Units	Quantity	Total Costs	Units	Life (5) (years)	Present Value	Beneficiary
Quantified Costs								
Pre-fabricated solar still	8000	\$	1	8000	\$	15	(\$79,002)	
Condenser	8000	\$	1	8000	\$	15	(\$79,002)	
Experimental solar stills	8000	\$	5	40000	\$	15	(\$395,012)	
New type of subsurface drip	30000	\$	1	30000	\$	15	(\$296,259)	
Pre-concentrator	8000	\$	1	8000	\$	15	(\$79,002)	
distilled water return system	2000	\$	1	2000	\$	15	(\$19,751)	
level controls	2000	\$	1	2000	\$	15	(\$19,751)	
pH conductivity	2000	\$	1	2000	\$	15	(\$19,751)	
temperature	2000	\$	1	2000	\$	15	(\$19,751)	
humidity	2000	\$	1	2000	\$	15	(\$19,751)	
Subtotal				104000				
Quantified Benefits								
Water conservation (2)	70	\$/acre	75000	5250000	\$/yr	100	(\$87,279,842)	Growers/ Districts/State Growers/Districts State
Salt harvest (3) (4)	20	\$/ton	300000	6000000	\$/yr	100	(\$99,748,391)	
Subtotal				11250000				
Non-Quantified Costs								
Non-Quantified Benefits								
Salt and selenium management on farms	n/a	n/a	n/a	n/a	n/a	n/a		State, CALFED Environment
No state/regional management of drainage water, salt and selenium	n/a	n/a	n/a	n/a	n/a	n/a		State CALFED Environment
Use of distilled water to increase municipal water supplies	n/a	n/a	n/a	n/a	n/a	n/a		State CALFED growers, communities
Technology transfer to other farms	n/a	n/a	n/a	n/a	n/a	n/a		State, CALFED Growers, Environment

(2) Grassland and Westland Water Districts.

(3) Additional 10% of irrigation water conserved (300,000 acres @ 2.5 AF/ac @10%).

(4) Salt value ranging from \$0/ton to \$80/ton; a conservative value of \$20/ton used for calculations.

(5) 300,000 acres @ 1 ton/acre of salt inflow

(6) 100=sustainable system